FOREST RESEARCH NEWS FOR THE SOUTH

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SOUTHERN & SOUTHEASTERN FOREST EXPERIMENT STATIONS, USDA FOREST SERVICE

Logging Residues Replenish Soil Nutrients

When pines are cut in the South, stems smaller than 3 inches in diameter and needles are left in the woods. These materials, called logging residues, are often viewed as a waste of the Nation's forest resources, and ways are being sought to utilize tree tops, needles, and even roots. U.S. Forest Service scientists have found, however, that these needles and small branches contain large quantities of plant nutrients, particularly nitrogen. Logging residues, therefore, may be an important source of the nutrients necessary to maintain forest productivity.

Drs. Jacques Jorgensen, Carol Wells, and Louis Metz, soil scientists at the Southeastern Forest Experiment Station in North Carolina, have been studying nutrient cycling in stands of loblolly pine, the most important of the southern pines. They are trying to find out how much of each of the major soil nutrients—nitrogen, phosphorus, and potassium—is added to and removed from the soil during a timber rotation. Nitrogen, the element that is most often in short supply in forest soils, is added to the soil in rain and by microorganisms in the soil. It also may be leached from the soil in heavy rains, and large quantities are removed when timber is harvested.

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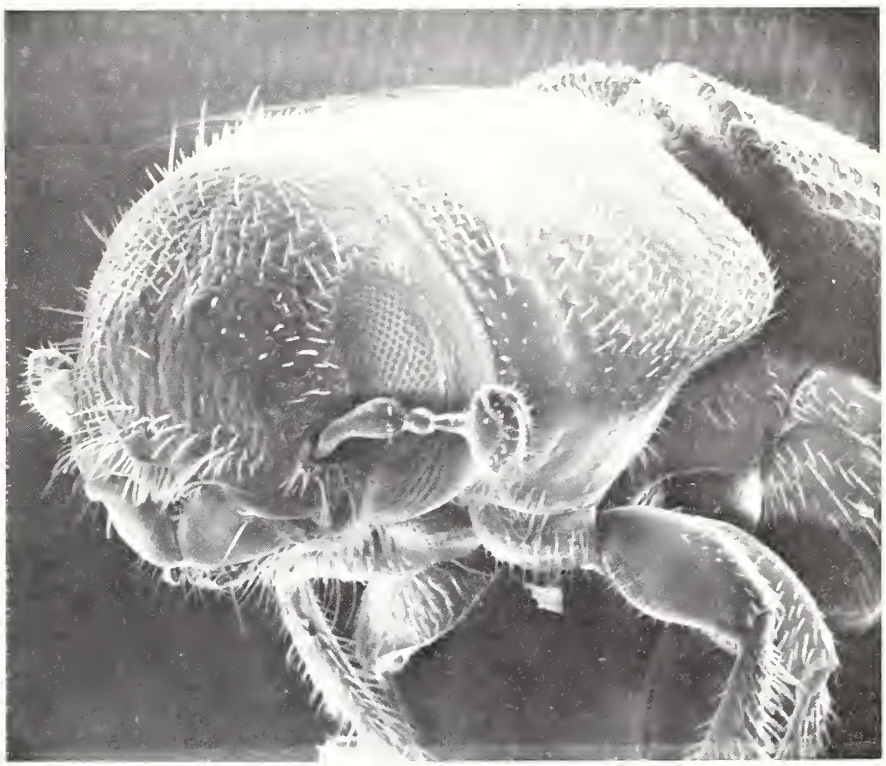


Target: Southern Pine Beetle

Damaging and unpredictable, the southern pine beetle ravages forests throughout the Southeastern States, destroying millions of dollars worth of timber each year. Stopping the insect's rampage is the goal of the U. S. Department of Agriculture's new Southern Pine Beetle Program.

The 5-year program is an intensified effort by two USDA agencies—the Forest Service and the Cooperative State Research Service—and several State agencies, universities, and private organizations to discover the materials and methods needed to control the beetle.

In 1973 alone the insect destroyed enough sawtimber to build 48,000 homes, according to Program Manager Robert C. Thatcher, an entomologist with over 20 years' experience in the Forest Service. "Currently about 58 percent of the South's 85 million acres of pine forests are affected by a beetle outbreak in 13 States," Thatcher pointed out. Damage is most severe in Texas, Louisiana, Alabama, Georgia, North Carolina, South Carolina, and Virginia. Timber mortality is expected to increase in 1975, especially in the south Atlantic Coastal States, Thatcher added.

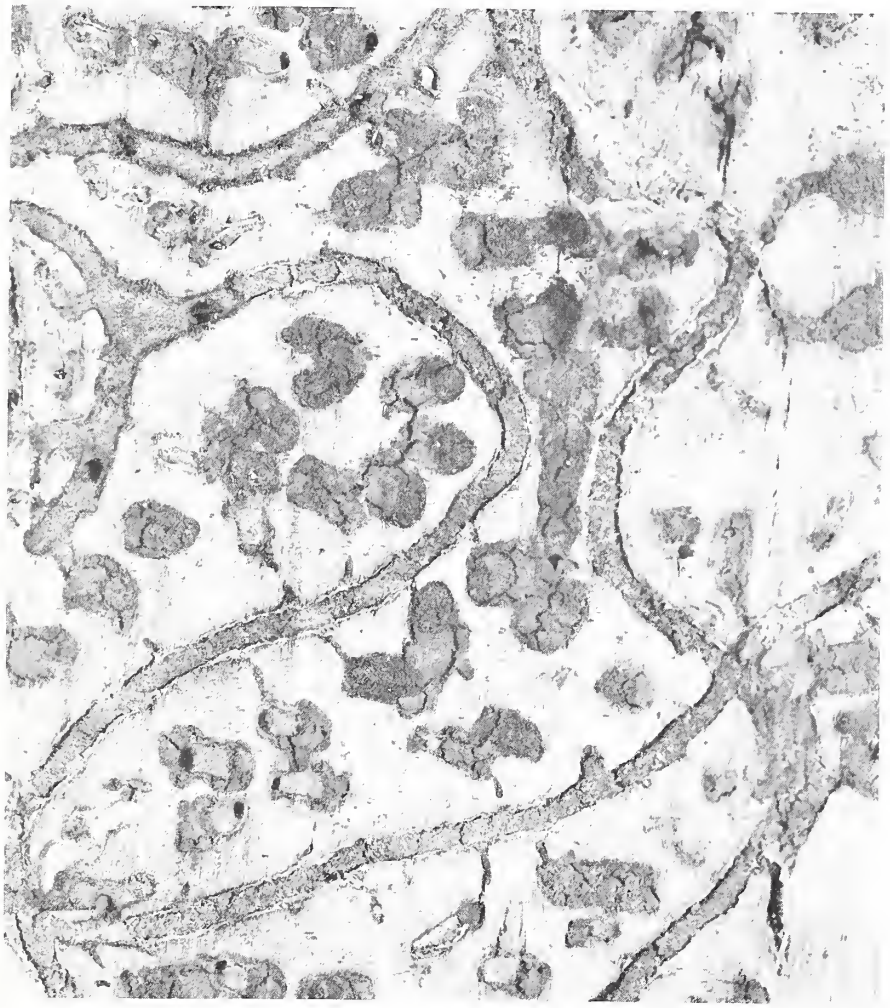
Thus, the search for controls is vitally important to southern foresters.

GRANTS AWARDED

Earlier this year grants totaling $1.9 million were awarded for 46 research and application investigations. These studies are varied but interrelated. Several researchers are studying the beetle's natural enemies, such as woodpeckers, parasites, and mites, to determine if these can be used to reduce beetle populations. Another possible control technique is to upset the delicate relationship between the beetle and its symbiotic microorganisms. Still other scientists are testing pesticides to find one that is both effective and environmentally safe.

"We are also trying to determine what makes forest stands susceptible to attack so that we can predict which stands are most likely to be attacked and concentrate treatment efforts there," Thatcher said. Silvicultural practices like fertilization might reduce a stand's susceptibility, and researchers are studying this possibility, too.

A basic need is for improved methods of surveying and predicting beetle populations. "Local populations may persist at low levels for extended periods and then suddenly 'blow up' with some infestations spreading from a few trees to several thousand within a few months," Thatcher explained. One survey technique under investigation is the use of a chemical attractant to lure beetles to trap trees. "We also are trying to determine the full economic impact of beetle infestations and to learn how much of the infested timber can be salvaged," Thatcher added.



Beneath the bark of a southern pine tree, beetles construct S-shaped tunnels where they lay their eggs. Young beetles develop in about a month, chew their way out of the bark, and fly to green trees nearby.

COORDINATING RESEARCH RESULTS

These research projects will involve over 70 scientists working in 12 universities, four Forest Service laboratories, and two State forestry organizations. Coordinating research activities is the job of Thomas L. Payne, formerly an associate professor of entomology at Texas A & M University and now research coordinator for the beetle program. "I try to keep each scientist informed about the progress of others, to making, to standardize ways of collecting and analyzing data so that findings by different scientists can be compared and correlated, and to avoid unnecessary duplication of effort," Payne explained.

APPLYING RESULTS

As promising control techniques are developed by the researchers, Paul E. Buffam, applications coordinator for the program, will see that they are properly field tested and are

(Continued on p. 8, col. 1)

Insects Eating Superseeds

Foresters are awed by the new generation of pines that is being bred in the South. They believe these pines will grow faster and straighter and be more disease resistant than earlier trees. To provide sufficient seeds of these supertrees for reforestation, huge investments have been made in pine seed orchards around the South. But, according to recent findings by Forest Service entomologists, cone and seed insects have not been showing much respect for the superseeds. Result? Disappointingly low production in pine seed orchards.

When the seed orchards were established, high production was anticipated. Orchard managers, therefore, were shocked in the late sixties and early seventies when they examined their production figures. Both the numbers of cones per tree and the numbers of seeds per cone were far lower than expected. And the causes were unknown.

Scientists from the Southeastern Forest Experiment Station were called in to investigate. Some possible answers in addition to insects were poor pollination and excessive amounts of self-pollination in the orchards.

Gary DeBarr and Bernard Ebel, research entomologists stationed in Athens, Georgia, carefully and frequently observed conelets and developing cones in seed orchards. Some cones were screened to keep insects away from them. Far more cones reached maturity when they were screened, and the numbers of seeds in those cones were far higher than in unscreened cones. The results were unmistakable. Insects were the major cause of poor production.

Furthermore, different insects cause the damage. Seedbugs and tip moths cause conelets to fall from the trees. Seedbugs and seedworms cause reduced yields of viable seed; coneworms, coneborers, and cone midges cause heavy cone losses in the second year of development.

Because of the large number of insect species that can cause damage, no single treatment can be recommended. The seed orchard manager must first find out which species are giving him problems. Only then can he choose appropriate control measures.

To help orchard managers identify troublesome insects, the Southeastern Area for State and Private Forestry and the Southeastern Forest Experiment Station have published a new booklet. In it, both the insects and the damage they cause are pictured in color. Identification keys are also provided. Copies of this booklet, "Southern Pine Seed and Cone Insects," are available free from the Southeastern Forest Experiment Station, P. O. Box 2570, Asheville, N. C. 28802.

Seedbug on southern pine cone.

Your Tree Needs Clean Air Too

Are the needles of your backyard pine turning reddish-brown or yellow? If you live in an area with polluted air, the trouble may not be in the soil. It may be caused by the industrial plant down the road. Like people, trees can tolerate only just so much air pollution. If pollution gets too great, trees cease to thrive. Their reactions depend upon the tree species and the type of pollutant. A color booklet recently published by the U.S. Forest Service describes typical symptoms.

According to the booklet, a high concentration of sulphur dioxide for a brief period usually causes conifer needles to turn reddish brown. Lower concentrations of this common pollutant cause yellowing of needles.

Ozone, another common pollutant in city air, can kill needle tips in conifers, particularly in the spring. Broadleaved trees and shrubs appear to be most susceptible to ozone in mid to late summer. On broadleaved trees typical symptoms are small flecks of

(Continued on p. 6, col. 2)

How Long Can You Keep a Good Tree Down?

Nuttall oak is a useful hardwood in bottom land forests of the South—the more so because it can grow on sites too wet for many other species. When the mature trees are harvested, however, there may be difficulty in getting a new stand started.

To begin with, young Nuttalls must be well established before the seed trees are removed. The problem here is that large acorn crops may be 10 or more years apart. When he gets a good seedling catch, therefore, the forester can't afford to take unnecessary chances. Does that mean he must remove the large trees immediately? Or can he wait a few years if it is inconvenient to harvest now? A study at Stoneville, Mississippi, has provided answers to this and some other questions about oak management.

The research began in 1958, when a very good acorn crop and favorable weather produced a dogs-hair seedling catch on parts of the Delta Experimental Forest. Researcher Robert L. Johnson selected 50 small stands, all under parent trees about 100 feet tall and 16 to 24 inches in diameter. He divided the stands into five groups, and then proceeded to release one group each year for 4 years. Release consisted of removing the big Nuttalls and lopping young stems of green ash, water hickory, and sugarberry.

Newly established Nuttall oak seedlings averaged 138,000 per acre. Seedbeds were so favorable that some seedlings (see inset) originated from acorns lying on the surface. Normally acorns must germinate underground.

Results were good. The seedlings stayed small until released and then began to grow in height at a rate averaging a foot a year. Many died off in early years, but that was hardly a misfortune. A forester who starts with 138,000 stems per acre is in deep trouble from overpopulation if he doesn't lose some along the way.

After the fourth year, Johnson still had one set of 10 unreleased plots. He waited until the ninth year, when it had become clear that fourth-year release was effective, and then freed three plots on which stocking remained high. The venture seemed chancy, but these trees also began to grow. When observations ended after 15 years, tree heights ranged from 13½ to 17 feet, with little relation to time of release. Diameters were about 1 inch.

Conditions on the seven unreleased plots made clear that a 9-year delay is probably too long for safety. Oaks survived beyond 8 to 10 years only where they received an hour or two of direct sunlight daily and where soil moisture supplies were good. Survivors were about 3 feet tall after 15 years and generally resembled trees 1 or 2 years old.

The green ash, water hickory, and sugarberry reproduction was even more tolerant of shade. The trees survived at least 15 years in the understory, and on released plots they were nearly 50 percent taller than the oaks when the study ended. Thus these species are interesting alternatives.

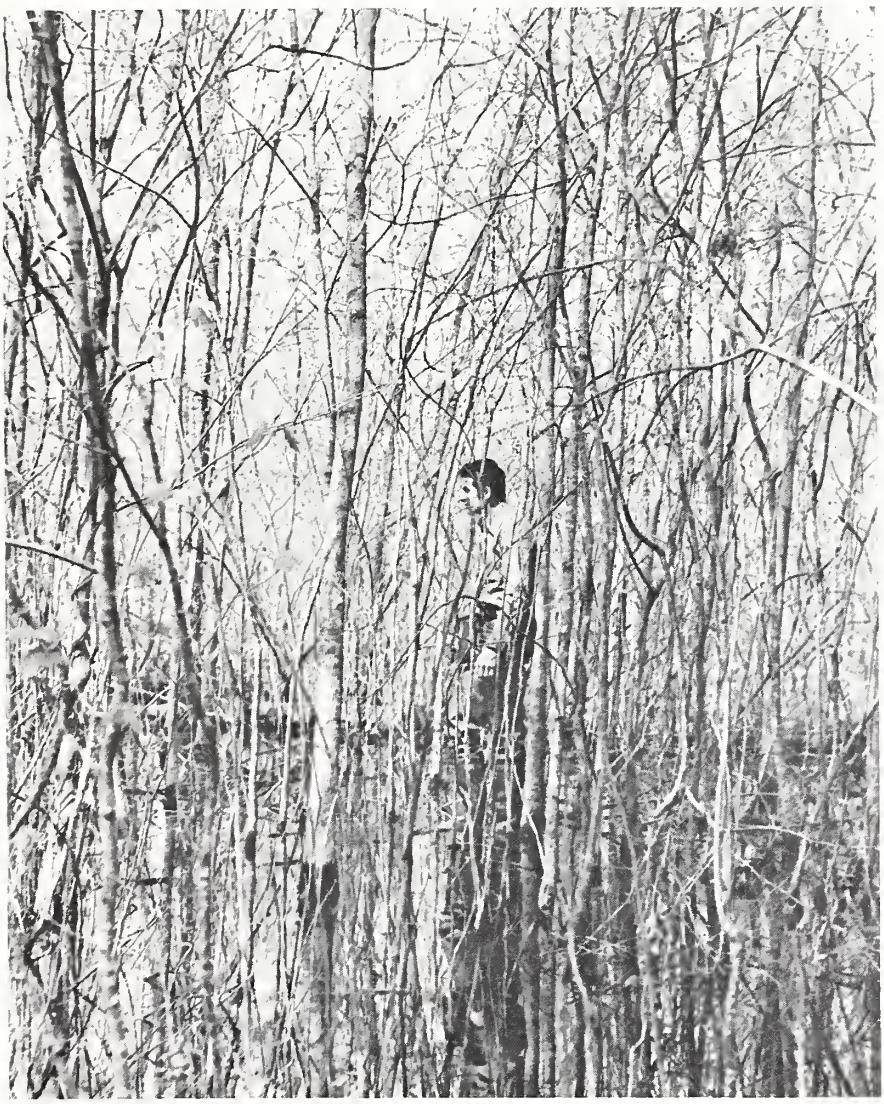
Within a year or two after release, dense vines covered all areas. They hindered tree growth but eventually the young stands grew above them.

Details of the research are reported in "Natural Regeneration and Development of Nuttall Oak and Associated Species," Research Paper SO-104 of the

Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, La. 70113.

The report closes with suggestions for forest managers:

- Release can be delayed at least 5 years after Nuttall oaks become established, and longer if associated species are to be favored.
- Since the new stand must be set before the old one is removed, type of harvesting system will have little effect on species composition. The main consideration is to create openings at least 1/5 acre in size, and preferably ½ acre. Small openings will not allow enough sunlight to reach the understory.
- Nuttall oaks may need a second release after 10 years or so, to prevent resuppression by green ash or sugarberry.



Typical stand 13 years after the seedlings were released to sunlight. The larger and clearly dominant tree is green ash, which outgrew the Nuttall oaks by 5 to 10 feet.

Timber Stand Improvement

Many small-forest owners can profitably manage their woodlands by investing in timber stand improvement (TSI). TSI promises a high rate of return, on relatively little capital, invested for a short period.

TSI involves cutting away or deadening low-value trees in an immature but merchantable stand. Some of the undesirable trees can be sold, while the best timber, left with more growing room, rapidly increases in value. The rate of return from TSI can be as high as 25 to 30 percent; and by growing quality timber of large size, the owner has a larger potential market for his product at harvest.

The usefulness of TSI for a particular stand depends upon characteristics such as its size, density of the undesirable trees, and stocking of the desirable ones. Where TSI is a feasible forestry practice, owners should be able to harvest their timber within 5 to 15 years after investment.

For further information, see Walter Anderson's article, "Timber Stand Improvement: an Entree to Forestry for Small-tract Owners," in the April 1975 issue of the *Journal of Forestry*. Reprints are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, La. 70113.

Search For Rarest Bird of Southern Forest Is Unsuccessful

Bachman's Warbler, the rarest bird indigenous to southern forests, is on the brink of extinction. Since 1950, only 31 sightings have been reported, and the bird is classified as an endangered species by the U.S. Fish and Wildlife Service. In the early 1900's, significant breeding populations were found in South Carolina, Kentucky, Missouri, and Alabama. Casual searches of these areas in the last 10 years have usually failed to locate the warbler.

An intensive search for Bachman's Warbler was initiated by Francis Marion National Forest in South Carolina. The Francis Marion was a major nesting area in former years, and many of the most recent sightings of the warbler were made in that vicinity. Through the cooperation of the National Audubon Society, the Francis Beidler Memorial Forest nearby was also included in the search.

The search was headed by Paul B. Hamel with the Department of Recreation and Parks Administration of Clemson University and Robert G. Hooper of the Southeastern Forest Experiment Station, Clemson, S.C. Thirteen volunteers contributed many hours to the search.

Typically, Bachman's Warbler is found in swamps and builds its nests in thickets of cane, palmetto, and blackberry. Areas with these characteristics were searched by playing a recording of the warbler's song at 400-foot intervals. During the breeding season, most songbirds respond to a recording of their song by flying to the source of the broadcast.

Between March 25 and May 15, about 3,250 acres of swamps were examined on the Francis Marion National Forest. Another 560 acres were covered on the Francis Beidler Memorial Forest. No Bachman's Warblers were found, but much of the habitat appeared suitable as nesting areas for the species. Plans are to continue the search next year.

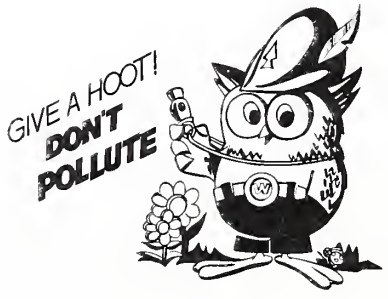
Clean Air . . .

dead tissue of various colors on the upper surfaces of leaves.

Flourides, oxides of nitrogen, ammonia, chlorine, hydrogen chloride, and particulates all can damage trees, and the symptoms are described and illustrated in the booklet. For types of damage that have been studied extensively particularly susceptible and resistant tree species are listed.

Pollution injuries often resemble those caused by other things, such as temperature extremes, nutrient or water deficiencies in the soil, and organisms. An expert may be required to identify the cause with certainty.

Copies of the booklet, "Air Pollution and Trees in the East," are available from the Southeastern Area, State and Private Forestry, 1720 Peachtree Road, N.W., Atlanta, Ga. 30309.



Stand Improvement In Northern Alabama

The Cumberland Plateau of northern Alabama and eastern Tennessee contains thousands of forest acres where stand quality has been badly depleted by fire and cutting but where seed trees of desirable species still remain.

If junk trees are taken out, to what extent will growth be improved? To find out, a study was begun some two decades ago in an area not far from Birmingham. Three stand-improvement treatments were tested. All were designed for use by owners of small as well as large tracts.

The first was a commercial improvement cut that removed only trees that would at least repay the cost of logging and thus leave the landowner with a small net profit. Pines, white oaks, and yellow-poplars of good quality were left for growth. In 19 years volumes per acre increased 778 cubic feet while stands that had been left in their original state gained 427 cubic feet. Corresponding annual rates of growth were 16 percent and 4 percent.

A second treatment required some investment. All low-value trees above 5½ inches in diameter were sold or deadened if they were competing with desirable trees, and additional poor stems were deadened if a pine seed tree was nearby. Growth increased at the rate of 22 percent each year, and by the end of 19 years volume had increased by 1,139 cubic feet per acre.

The third treatment called for still more investment. All low-value trees above 1½ inches in diameter were either sold or deadened. Additionally, trees smaller than 1½ inches were cut if they were overtopping desir-

able seedlings. Nineteen-year growth here was 1,498 cubic feet per acre, and the annual growth rate was 65 percent.

Which was best? That depends on how much an owner has to invest and how soon he wants to have a well-stocked stand. The least of the treatments was much better than none at all. And many low-quality trees that could not be sold when the study began would now find a ready market. One possibility is to concentrate the most costly treatments on the best sites, so that rapid growth will quickly repay the investment.

Details of the study are reported by Glendon W. Smalley in Research Paper SO-100, "Development of Pine-Hardwood Stands in North Alabama Following Improvement Cuttings." Copies are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, La. 70113.

Nursery Disease Handbook Available

The U.S. Department of Agriculture has issued a handbook to assist nurserymen, foresters, extension pathologists, and other workers in identifying, evaluating, and controlling diseases encountered in forest nurseries. The handbook covers root and soilborne diseases, stem and branch diseases (cankers), foliage diseases, and storage molds; excluded are nutrient deficiencies and herbicide and environmental injuries (except air pollution).

"Forest Nursery Diseases in the United States" (Agriculture Handbook No. 470), is available for $3.50 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Third National Wild Turkey Symposium

The Third National Wild Turkey Symposium was held February 11-13, 1975, at San Antonio, Texas. The symposium and subsequent field trip to the Edward's Plateau were sponsored by the Texas Chapter of the Wildlife Society and the Texas Parks and Wildlife Department.

Thirty-three papers included information on the status of wild turkeys, parasites and disease, turkey production and survival, food and feeding habits of poults, effects of land use practices on wild turkey habitat; roosting behavior, turkey harvest management, and economics and esthetics. Results of recently completed research were emphasized.

Proceedings of the symposium are now available and can be obtained by writing to the Texas Parks and Wildlife Department, Attention Wild Turkey Program Leader, John H. Reagan Building, Austin, Texas 78701. The price is $6.00.

Logging Residues . . .

Various portions of the trees in a 16-year-old pine plantation were chemically analyzed, and it was found that a large proportion of the nitrogen was in needles and small branches. The scientists estimate that taking entire tree tops, including needles and small limbs, would remove almost 2½ times as much nitrogen from the site as a typical harvester does today.

In a recent article in the *Journal of Forestry*, "The Nutrient Cycle: Key to Continuous Forest Production," the scientists question whether the increase in wood production associated with harvest of needles and small limbs is worth the loss in soil nutrients. They believe that in certain circumstances whole-tree logging might deplete soil nutrients over a series of timber rotations.

The scientists are quick to point out that their results represent a single situation—that soils and timber types are highly variable. Losses in nutrients, they say, might be offset by adding fertilizer as a farmer does. But they wonder whether the income from the harvest of limbs and needles would be sufficient to pay for the fertilizer. They think that in some circumstances logging residues may be more valuable in the woods than at a processing plant.

Reprints of the [*Journal of Forestry*] article are available on request from the Southeastern Forest Experiment Station, P. O. Box 2570, Asheville, N. C. 28802.

When they decay, pine needles and small limbs return large quantities of nutrients to the soil.

made available to landowners as quickly as possible. Several field studies on survey methods and toxicants are already underway.

"To date, attempts at control have been sporadic and largely ineffective," Buffam explained. The usual approach is to cut infested trees and either burn them, remove them, treat them with chemicals, or leave them exposed to the sun. "We hope to give the forester more reliable means of minimizing the effects of current beetle attacks and of managing his forests to prevent future outbreaks," Buffam said. Buffam was formerly leader for Environmental Quality Evaluation with the Southeastern Area of State and Private Forestry.

The program's three staff members, Thatcher, Payne, and Buffam, are headquartered in Pineville, Louisiana, College Station, Texas, and Atlanta, Georgia, respectively. Participating scientists are located throughout the South and as far away as California and New York. "Pooling the talents of all these people gives us a good chance of solving the pine beetle problem that has plagued southern foresters for decades," Thatcher said.

The Southern Pine Beetle Program is one of three expanded research and development programs launched by the Department of Agriculture last December. The other two are aimed at the Douglas-fir tussock moth, which defoliated nearly 800,000 acres in Washington, Oregon, and Idaho last year, causing an estimated loss of more than $30 million and at the gypsy moth, which defoliated 2,800 square miles of hardwoods in the Eastern United States in 1973 and is continuing to spread.

If you would like additional information about the Southern Pine Beetle Program or would like to receive the program's newsletter, contact Dr. Robert C. Thatcher, Program Manager, USDA Southern Pine Beetle Program, Alexandria Forestry Center, 2500 Shreveport Hwy., Pineville, La. 71360.

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